PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : B31F 1/07, B32B 31/00

A1

(11) International Publication Number: WO 94/06623

(43) International Publication Date: 31 March 1994 (31.03.94)

(21) International Application Number: PCT/GB93/01962

(22) International Filing Date: 16 September 1993 (16.09.93)

(30) Priority data:
9219605.4 16 September 1992 (16.09.92) GB
9302646.6 10 February 1993 (10.02.93) GB

(71) Applicant *(for all designated States except US)*: J R CROMPTON LIMITED [GB/GB]; Elton Paper Mill, Bury, Lancashire BL8 2AS (GB).

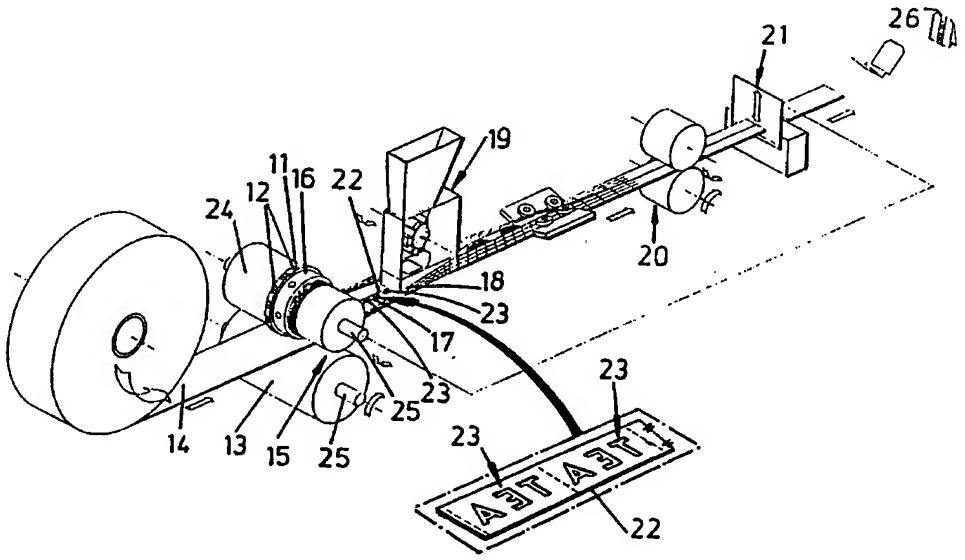
(72) Inventors; and
(75) Inventors/Applicants *(for US only)* : BASSETT, David, Wyn [GB/GB]; 19 Glenarm Walk, Brislington, Bristol BS4 4LS (GB). GBUR, Ivan [GB/GB]; 17 Cloister Drive, Darwen, Lancashire BB3 3JX (GB). TOMKINSON, Brian [GB/GB]; The Barne, 17 Oaks Lane, Bradshaw, Bolton, Lancashire BL2 3BR (GB).

(74) Agent: MOCK, Hans; Marks & Clerk, Suite 301, Sunlight House, Quay Street, Manchester M3 3JY (GB).

(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: IMPROVEMENTS TO THE PATTERNING OF TISSUE PAPER



(57) Abstract

In a process for patterning tissue paper, e.g. for tea bags, a continuous strip of paper is embossed in the course of conversion of the strip into tissue paper products. Apparatus for converting the tissue paper into patterned product, has embossing means for embossing the strip in the course of such conversion. The invention further provides a process and apparatus for patterning tissue paper comprising subjecting the paper to the action of a heated embossing roller coated with a liquid adapted to enhance the patterned effect obtained by the embossing operation and/or the strength of the paper in the embossed area.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**FR**	France	**MR**	Mauritania
AU	Australia	**GA**	Gabon	**MW**	Malawi
BB	Barbados	**GB**	United Kingdom	**NE**	Niger
BE	Belgium	**GN**	Guinea	**NL**	Netherlands
BF	Burkina Faso	**GR**	Greece	**NO**	Norway
BG	Bulgaria	**HU**	Hungary	**NZ**	New Zealand
BJ	Benin	**IE**	Ireland	**PL**	Poland
BR	Brazil	**IT**	Italy	**PT**	Portugal
BY	Belarus	**JP**	Japan	**RO**	Romania
CA	Canada	**KP**	Democratic People's Republic of Korea	**RU**	Russian Federation
CF	Central African Republic			**SD**	Sudan
CG	Congo	**KR**	Republic of Korea	**SE**	Sweden
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovak Republic
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LU**	Luxembourg	**TD**	Chad
CS	Czechoslovakia	**LV**	Latvia	**TG**	Togo
CZ	Czech Republic	**MC**	Monaco	**UA**	Ukraine
DE	Germany	**MG**	Madagascar	**US**	United States of America
DK	Denmark	**ML**	Mali	**UZ**	Uzbekistan
ES	Spain	**MN**	Mongolia	**VN**	Viet Nam
FI	Finland				

IMPROVEMENTS TO THE PATTERNING OF TISSUE PAPER

This patent relates to the patterning of tissue paper which term is used herein to represent wet or dry laid paper having a basis weight between 6 and 50 g/m^2 preferably between 10 and 26g/m^2 and used for example as filtration bags used for the infusion of products such as tea or coffee.

There exists within the tea and coffee processing industries considerable interest in providing brand identification upon product bags for security and aesthetic appeal. This can take the form for example of patterning or discrete logo images introduced into the tissue paper at the production stage.

Commercial techniques in the past have centred upon water jet technology, a process whereby fibre distribution is disrupted at the papermaking formation stage to create regions of high and low fibre density which when viewed against the darker tea or coffee bag content provide a pattern by optical contrast.

However, it is recognised by those skilled in the art that the subsequent regions of low fibre density result in significant reductions in paper strength and moreover give rise to the loss of ingredient particles due to the occurrence of voids within these regions.

It is well known within the paper industry that the combined action of heat and pressure on a uniform tissue paper web results in a compaction of the fibres and a reduction in thickness.

This process commonly referred to as hot calendering also affords improved surface smoothness and moreover a reduction in opacity, and is most conveniently achieved by passing the tissue paper through the nip of hot rolls.

These properties as illustrated in Table 1 are achievable for tissue papers constructed from predominantly cellulosic fibres as well as mixtures of cellulosic, synthetic and thermoplastic fibre compositions.

Furnish	Manila Softwood		Manila Softwood Thermoplastic		Manila Softwood Rayon Thermoplastic	
Substance	12.2		16.2		16.6	
Sample Type	Control	Calendered	Control	Calendered	Control	Calendered
Calender Temp °C	-	190	-	190	-	190
Calender Force N/mm	-	30	-	83	-	83
Thickness µm	56	17	78	27	86	24
Optical Transmission %	31	43	33	41	35	44
Optical Scatter %	10	8	12	10	11	10
Tensile Length Lgm/mm	93	50	69	23	46	29
Tensile Length Cgm/mm	32	23	27	16	19	13

TABLE 1: HOT CALENDERED TISSUE PAPERS

The given optical transmission values were obtained by a parallel beam of light from a first light source transmitted perpendicularly through the sample and recorded by a photocell whilst optical surface scatter was determined by the proportion of light from a second light source reflected back to a photocell placed close to a second light source and inclined at an angle of 45° to the paper surface.

The hot calendering was conducted on a commercial two plain steel roll stack over the full width of the paper at the given temperature with the nip pressure exerted by hydraulic rams.

A further advancement of the technique has been realised by the paper industry whereby the pressure rolls' smooth continuous surfaces are replaced by surfaces incorporating castellations or impressions which to all intents and purposes provide a localised calendering on discrete areas of the paper as it progresses through the nip.

Such a process is commonly referred to as embossing which term is used herein to refer to any localised calendering technique resulting in a profile in the thickness of paper in the longitudinal or transverse direction of the paper between the affected areas. It is also recognised that the application of heat during the embossing process improves fibre compaction giving rise to the terminology "hot embossing".

Experiments conducted with a commercial hot embossing unit further demonstrated that the hot calendering physical changes exemplified in Table 1 could be duplicated within the embossed regions as illustrated in Table 2. In these examples, the emboss consisted of a diamond shaped lined structure occupying 32% of total surface area.

Furnish	Manila Softwood		Manila Softwood Thermoplastic	
Substance gsm	12.2		16.2	
Sample Region	Bulk	Embossed	Bulk	Embossed
Embossing Force N/mm	-	40	-	53
Embossing Temperature	-	190	-	190
Thickness μm	52	22	82	22
Optical Transmission %	34	45	36	43
Optical Scatter %	10	7	10	9
Tensile Strength Lgm/mm	96	39.1	71	30.7
Tensile Strength Cgm/mm	29	13.4	26	13.4

TABLE 2: HOT EMBOSSED TISSUE PAPERS

Enhanced optical transmission coupled with reduced optical backscatter resulted on visual inspection in a high degree of contrast between the embossed region and remaining bulk areas when viewed against a dark background such as tea or coffee.

Whilst the optical properties afford adequate contrast for pattern definition, the described processes unfortunately result in significant reductions in strength properties of the tissue as demonstrated also in Tables 1 and 2. However, depending upon the basis weight or substance of the tissue paper and the product into which the paper is to be converted, the reduction in strength may be acceptable.

According to a first aspect of the present invention there is provided a process for patterning tissue paper as herein defined by embossing a continuous strip of paper characterised in that embossing is carried out in the course of conversion of the strip into tissue paper products.

According to a second aspect of the present invention there is provided apparatus for converting tissue paper into patterned product, comprising means for converting a continuous strip into said product, characterised in that embossing means is provided for embossing the strip in the course of such conversion.

According to a third aspect of the present invention there is provided a process for patterning tissue paper as herein defined comprising subjecting the paper to the action of a heated embossing roller coated with a liquid adapted to enhance the patterned effect obtained by the embossing operation and/or the strength of the paper in the embossed area.

According to a fourth aspect of the present invention there is provided apparatus for patterning tissue paper as herein defined, comprising an embossing roller defining a nip with a coacting pressure roller, means for heating the embossing roller, means for guiding the paper into the nip, and means for coating the embossing roller with a liquid adapted to enhance the patterned effect obtained by the embossing operation.

The invention will now be further described by way of example only with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic view of one embodiment of apparatus in accordance with the invention;

Fig. 2 is a schematic view of one embodiment of tea bag conversion machine illustrating the invention;

Fig. 3 is a schematic view of a second embodiment of tea bag conversion machine illustrating the invention, and

Fig. 4 is a further embodiment of the invention incorporated in a schematically illustrated tea bag conversion machine.

Referring now to Fig. 1 of the drawings, a papermaking machine is indicated diagrammatically at PM and produces paper P which is guided by suitable guide means (not shown) through the nip of a roller pair in which the lower roller 1 provides a counter-surface for an upper, heated embossing roller 2 having a profiled surface including raised portions or projections indicated diagrammatically at 2a.

The papermaking machine produces tissue paper having a basis weight of 6 to 50 g/m^2 pr ferably 10-26 g/m^2. The papermaking machine may use a wet or dry laying process to produce tissue paper of the kind generally known as long fibred paper or non-woven material and the term "tissue paper" is used herein to include all of these materials.

A wet laid tissue paper may, for example, be made on a conventional inclined wire machine used for making long-fibred tissue paper suitable for conversion into infusion bags.

The tissue paper may have any desired fibre composition. For example, the paper may be made entirely from cellulosic fibres. Alternatively, the paper may comprise a mixture of cellulosic fibres and synthetic plastics material which may be in the form of plastics, e.g. polypropylene, fibres. One example of tissue paper that may be treated by the process according to the invention has a layer (upper or lower) of predominantly synthetic plastics fibres, e.g. polypropylene, and a layer (lower or upper) of predominantly cellulosic fibres.

As the paper P passes through the nip of the roller pair 1, 2, the projections 2a of the embossing roller 2 produce compressed areas in the paper which in the finished product reflect and/or transmit light differently from the remainder of the paper so as to achieve a patterned effect. By changing the pattern of projections on the embossing roller 2 any desired patterning effect of the paper P may be achieved, e.g. geometric patterns, trade marks, company logos or other markings or combinations thereof so as to achieve an aesthetically pleasing effect. The patterning produced by the embossing process is enhanced by the controlled application of an additive, e.g. a synthetic plastics material such as polypropylene, in a molten state to the compressed areas so as to fuse together the bulk web within these regions thereby enhancing the patterned effect. This is achieved by a reduction in light scattering within the fibres of the web by the continuum of additives such as polypropylene surrounding the fibres and thereby enhancing the transmission of light. A major advantage is that the strength of the paper within the compressed regions is nhanced by the additive.

The additive may be a clear or colourless material or, alternatively, it may be coloured to alter the light transmission and/or

reflection characteristics of the compressed regions thereby furth r enhancing the patterned effect. The colouring may be achieved by the use of dyes which may be encapsulated in known manner for physiological acceptability. Alternatively, colouring may be achieved by the use of fine particulate material or dust obtained from the infusion material, e.g. tea dust.

The molten additive, with or without colouring, is applied to the embossing roller 2 by a heated transfer roller 3 in rolling contact with the embossing roller 2 and a coating roller 4 which is partially immersed in a heated bath 5 of molten additive. A doctor blade 6 in contact with the coating roller 4 ensures that a uniform layer of additive is picked up by the roller 4 and transferred via the transfer roller 3 to the projections of the embossing roller 2. These projections deliver the additive in the course of creating the locally compressed areas in the paper.

By way of an example, granules of a thermoplastic polyolefin (hereafter referred to as hot melt) are melted in the metal reservoir using a hot plate located beneath the reservoir heated to 200°C. At the same time, the transfer rollers (3 and 4) are heated to approximately 120°C by small cartridge heaters mounted in their core. The transfer rollers are set in motion while the doctor blade 6 is adjusted to provide an even coating of hot melt on the roller surfaces. The coating roller 3 then transfers to the protrusions of the embossing roller which is heated to 120°C. Sample paper from a coil is fed between the embossing roller and the lower roller at a speed of approximately 10 metres/min with a force of approximately 30N/mm being applied between them. It is observed that the hot melt from the protrusions of the embossing roller is impregnated into the paper where it rapidly solidifies.

Fine tea dust added to the reservoir of hot melt as a suspension and to a concentration of 20% by weight, results in a coloured embossing pattern being impregnated into paper by encapsulating the dust into the thermoplastics material as it solidifies.

A further advantage has been realised by the significantly improved paper strength characteristics within the coated and compressed regions as demonstrated in Table 3.

Furnish	Manila Softwood		Manila Softwood Thermoplastic	
Substance gsm	12.3		16.4	
Sample Type	Control	Hot Melt Coated	Control	Hot Melt Coated
Coating Pressure N/mm	-	29	-	29
Coating Temperature	-	120	-	120
Coat Application gsm	-	13	-	12
Thickness μm	61	27	75	30
Optical Transmission	28	49	30	50
Optical Scatter	13	8	12	10
Tensile Strength Lgm/mm	91	85	60	54
Tensile Strength Cgm/mm	25	23	26	22

TABLE 3: HOT COATED TISSUE PAPERS

Although the hot melt dose (coat application gsm) appears high it applies to the patterned areas which occupy a small proportion of the bulk area.

In the illustrated examples the patterning technique has been applied to paper in the final stage of manufacture. It will be appreciated that finished paper may be treated in the same way in which case the paper P will be supplied to the roller set 1, 2 from a reel or coil which may be prepared in dimensions suitable for use on the subsequent conversion machine for converting the tissue paper into the bag product.

It has been found that very accurate registration of discrete pattern images can be achieved by scaling down the embossing machinery to a size such that it can conveniently be integrated with the bag conversion machinery and which enables the embossing rolls to be synchronised with the sealing and slitting mechanism of such machinery.

In the apparatus of Fig. 2 a heated embossing die in the form of a disc 11 with equispaced image recesses 12 (each consisting of the word TEA) engraved onto its periphery is pressed against a plain roll 13 whilst tissue paper 14 from a reel is fed into the nip 15. A threaded collar nut 16 locates the die which also facilitates convenient die pattern exchange. The embossed paper 17 is then fed to folding 18, tea dosing 19, sealing 20 and cutting 21 stages of a

standard tea bag conversion machine (for example a single lane TEEPACK CONSTANTA machine for cellulosic paper or a multi-lane SIG heat seal conversion machine for heat sealable paper). In use, the embossing die 11 is pressed with a force of 10-50N/mm against the plain roll 13 whilst the tissue paper 14 is fed to the nip 15 to provide a transparent strip 22 in the tissue paper containing opaque imprints 23 of the engraved images 12 registered on the final product bag 26. The embossing rolls 13, 24 are electrically heated to a temperature of 180°C by cartridge elements 25 mounted in their core, whilst the embossing die 11 is fixed to the roll 24 in heat exchanging relationship therewith by the threaded collar 16.

It was found that in use of the apparatus of Fig. 2 the embossed image remained in a constant position on the tea bags manufactured. In a further experiment, a similar sample of paper was embossed using the same embossing unit but subsequently reeled to normal tension prior to converting separately into tea bags on the same tea bag machine. In this case the embossed image ran out of registration by 5mm after conversion of only 200 metres of paper. Bearing in mind that conversion paper lengths of 3000 metres are common, the requirement for precision registration of images is obviously of importance.

Surprisingly it was found that tissue paper comprising solely of long cellulosic wood fibres together with wet strength agents e.g. kymene (Hercules Chemicals Ltd) and sodium carboxy-methyl-cellulose, could be embossed to provide an adequate embossed transparent stripe interrupted by the discrete images. Similar results were achieved for tissue papers containing thermoplastics in their construction.

It was also found that paper strength characteristics in the machine direction was not reduced unduly by the embossing process since the transverse extent of the embossed pattern occupies only a small proportion of the total paper width.

Naturally a technique such as that described above by reference to Fig. 1 could be adapted to this paper processing on the conversion machine to enhance transparency and paper strength as shown in Table 3. Fig. 3 illustrates the apparatus of Fig. 2 incorporating a device as shown in Fig. 1 with reference numerals increased by 100 for similar parts.

In a further embodiment illustrated schematically in Fig. 4, parts corresponding to those of Fig. 2 are given reference numerals increased by 200 and are not further described. A thin strip 230 40μm thick x 3mm wide of thermoplastic material e.g. polyamide is fed from a reel 231 into the nip 215 beneath the tissue paper 214 where it is laminated into the tissue paper by the action of the heated embossing die 211.

It was found that preferred results were obtained when the lower roll temperature was maintained at a temperature below the melting point of the thermoplastic strip (e.g. 60°C for polyamides) to facilitate release of the paper from the lower rolls. An impressively shiny transparent stripe together with an image emboss was achieved on the outside of the subsequently converted tea bags. It was also found that the strength of the laminated region was significantly greater than the remaining tissue paper as demonstrated in Table 4.

Furnish	Manila Softwood		Manila Softwood Thermoplastic	
Substance gsm	12.3		16.0	
Sample Type	Control	Laminate	Control	Laminate
Embossing Temp °C	-	180	-	160
Embossing Force N/mm	-	38	-	38
Tensile Strength Cgm/mm	28	>100	25	>100
Tensile Strength Lgm/mm	24	>100	35	>100

TABLE 4: HOT LAMINATED TISSUE PAPERS

By embossing the tissue paper in the course of conversion of a continuous strip into tea bags or other paper products it is possible to avoid the registration problems that would inevitably occur as a result of stretching if embossing were carried out at an earlier stage, e.g. during paper manufacture or during subsequent reeling from machine rolls to coils of suitable width for use on standard conversion machines. As described above, such stretching causes a failure of registration of the embossed pattern with the final product.

It will be appreciated that the invention is concerned broadly with changing the appearance of tissue paper products, particularly but not exclusively tea bags, by a pressing technique which has been referred to as localised calendering or embossing, these terms being used synonymously to mean a pressing operation resulting in deformation of the paper profile and a consequent change in the optical properties of the compressed area or areas. A simple example of such embossing is a continuous strip extending lengthwise of a tea bag and having greater transparency than the remainder of the bag. Such a strip enables closer visual inspection of the tea bag contents than has hitherto been possible. The strip may of course be replaced by discontinuous areas or a single embossed area serving the same purpose or intended merely as pattern or ornament. As described, the embossing or localised calendering may produce its useful and/or decorative effect by using an embossing die in which significant parts, such as letters, of the final pattern are provided by projections or recesses in the die with the background against which such significant parts are viewed being provided by recesses or projections respectively. For example, the embossing die of Fig. 3 produces a continuous stripe by localised calendering and the TEA characters, which are seen in the product against the background of this relatively transparent stripe, are produced by the recesses 22 and remain of the same opacity as the remainder of the paper.

Although the description has been confined to hot embossing it will be appreciated that similar effects may be achieved, possibly with application of greater pressure, alternative additions or embossing at ambient temperatures. Also, embossing may be carried out simultaneously on a plurality of paper strips derived from a common paper web, for example in the multi-lane SIG machine mentioned above.

CLAIMS:

1. A process for patterning tissue paper as herein defined by embossing a continuous strip of paper characterised in that embossing is carried out in the course of conversion of the strip into tissue paper products.

2. A process as claimed in claim 1, wherein the embossing is carried out simultaneously on a plurality of said strips derived from a common paper web.

3. A process as claimed in claim 2, wherein the embossing is effected by a pair of cooperating rollers.

4. A process as claimed in claim 3, wherein at least one of said rollers is heated.

5. A process as claimed in any one of the preceding claims, wherein the paper is made predominantly of cellulosic fibres.

6. A process as claimed in any one of the preceding claims, wherein a narrow band of thermoplastics material is applied to the or each paper strip in the embossing region so as to become laminated thereto by pressure and/or heat.

7. A process as claimed in any one of the preceding claims, wherein the paper is made at least partially of thermoplastics fibres.

8. A process as claimed in any one of claims 1 to 5, wherein a liquid adapted to enhance the strength and/or appearance of the embossed area of the paper is added to said area in the course of embossing.

9. A process as claimed in any one of claims 1 to 5, wh rein the embossing produces a continuous strip or discrete areas which are relatively more transparent than the surrounding paper so as to permit improved inspection of the contents of the product, for example tea in a tea bag.

10. Apparatus for converting tissue paper into patterned product, comprising means for converting a continuous strip into said product, characterised in that embossing means is provided for embossing the strip in the course of such conversion.

11. Apparatus as claimed in claim 10, wherein means is provided for slitting a common web into a plurality of said strips and the embossing means is adapted to emboss said plurality of strips simultaneously.

12. Apparatus as claimed in claim 10 or 11, wherein means is provided for supplying to the embossing means a liquid adapted to enhance the strength and/or appearance of the embossed area of the paper.

13. A process for patterning tissue paper as herein defined comprising subjecting the paper to the action of a heated embossing roller coated with a liquid adapted to enhance the patterned effect obtained by the embossing operation and/or the strength of the paper in the embossed area.

14. A process as claimed in claim 13, wherein the paper comprises a first layer of predominantly synthetic plastics fibres and a second layer of predominantly cellulosic fibres.

15. A process as claimed in claim 13 or 14, wherein the liquid is transferred to the embossing roller by means of a heated transfer roller which receives the liquid from a molten source e.g. a roller rotating in a bath containing the liquid.

16. A process as claimed in any one of the preceding claims, wherein the liquid is a molten synthetic material, e.g. polypropylene.

17. A process as claimed in any one of the preceding claims, wherein colouring is added to the liquid to further enhance the patterned effect.

18. A process as claimed in claim 17, wherein the colouring is a dye.

19. A process as claimed in claim 17, wherein the colouring is provided by tea dust.

20. Apparatus for patterning tissue paper as herein defined, comprising an embossing roller defining a nip with a coacting pressure roller, means for heating the embossing roller, means for guiding the paper into the nip, and means for coating the embossing roller with a liquid adapted to enhance the patterned effect obtained by the embossing operation.

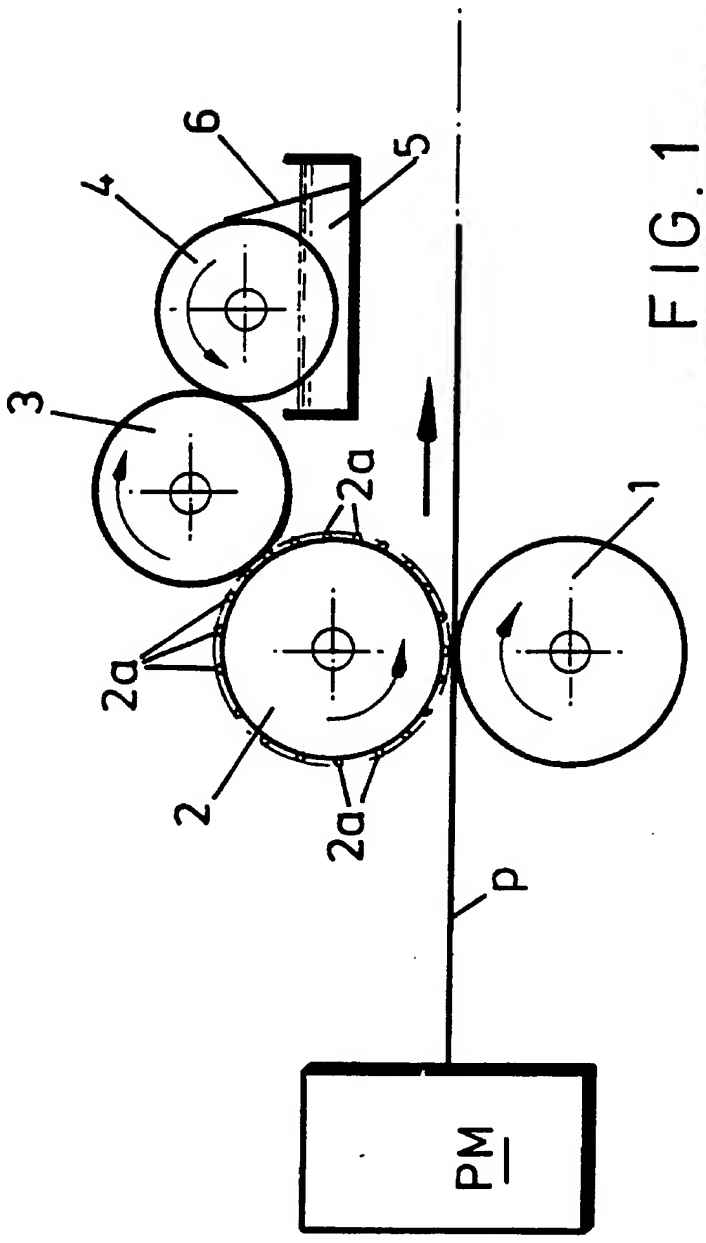


FIG. 1

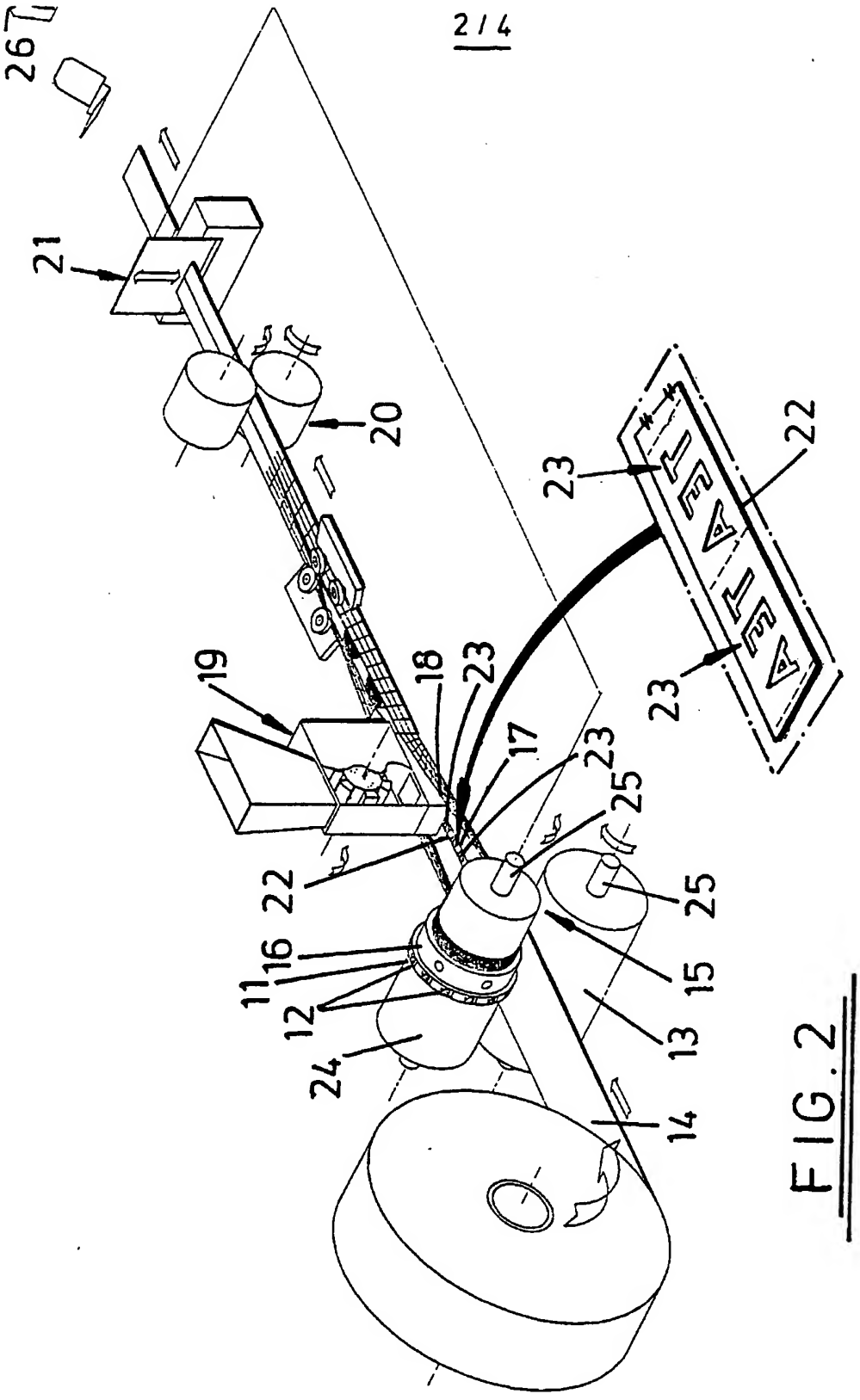


FIG. 2

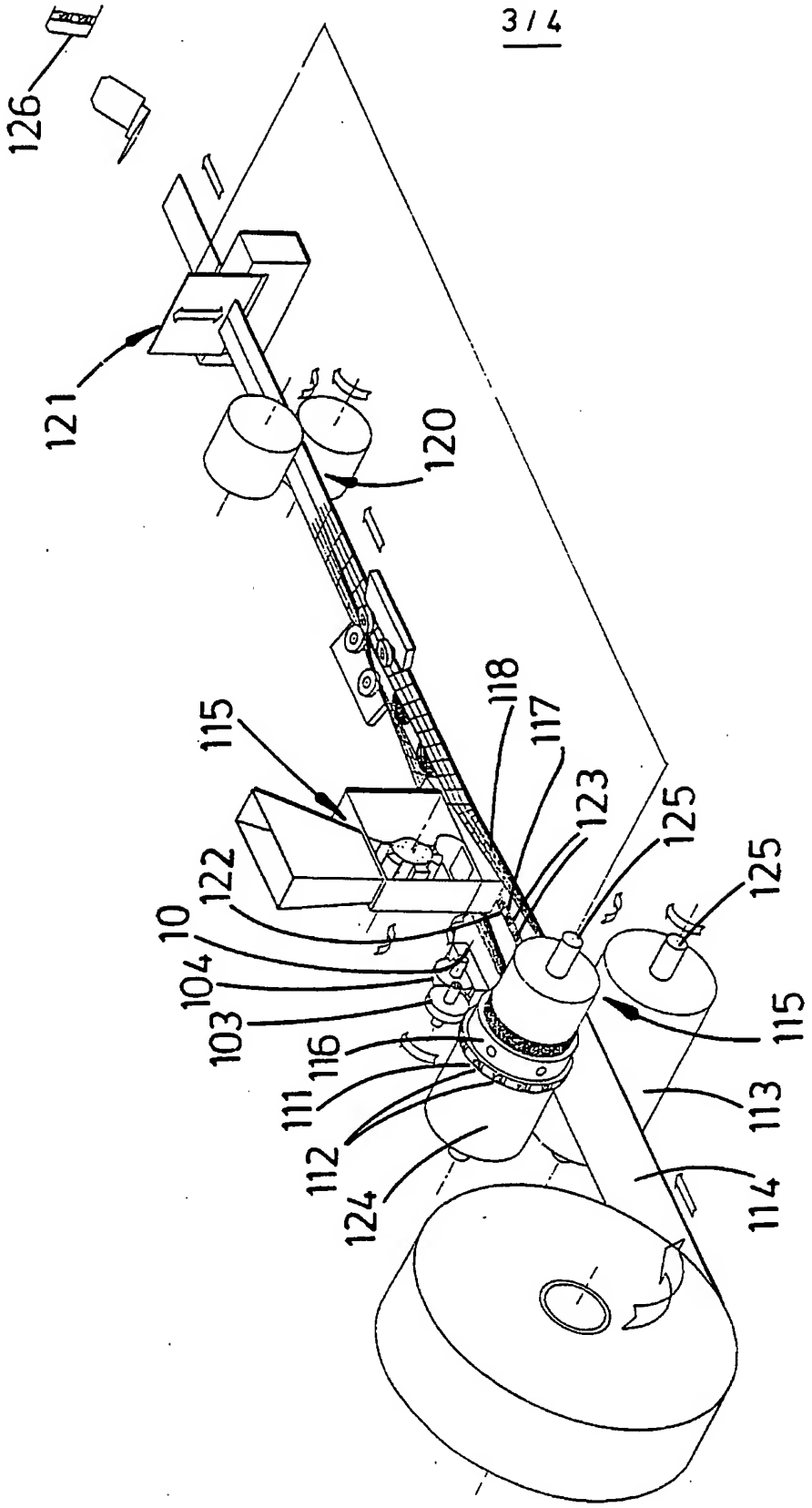

126
121
120
118
117
115
123
125
125
122
10
104
103
116
111
112
124
115
113
114

FIG. 3

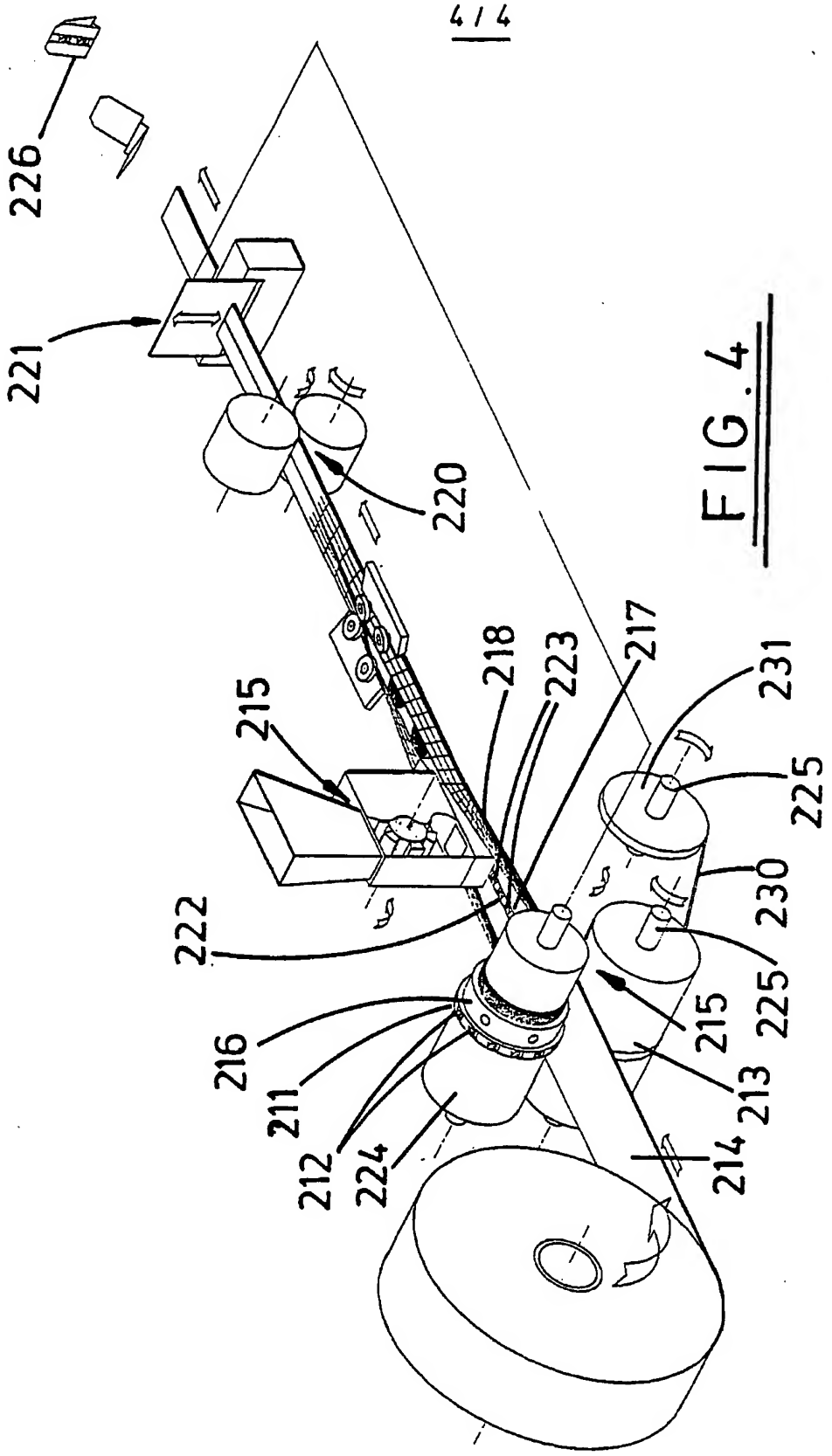

226
221
220
215
218
223
217
231
225
222
230
216
211
212
224
213
214

FIG. 4

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/GB 93/01962

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 B31F1/07 B32B31/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 B31F B31B B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP,A,0 446 138 (BOLLORE TECHNOLOGIES) 11 September 1991 see the whole document	1-7,9,10 8,11-18, 20
X Y	DE,C,681 812 (HAKLE-KLOSETTPAPIERFABRIK KLENK & CO.) 2 October 1939 see page 1, line 24 - line 49; claim 1	1-3,5 8,11-18
X	DE,A,37 00 649 (EUL & GÜNTHER GMBH & CO KG) 21 July 1988 see column 2, line 43 - line 68; claims 1,4; figures 1-5	1-5,10
X	US,A,3 478 141 (J.J. DEMPSEY ET AL) 11 November 1969 see column 2, line 34 - line 48; claims 1-3; figure 1	1,7,10

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 November 1993	06 -01- 1994

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Van Nieuwenhuize,O

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Intern. .al Application No
PCT/GB 93/01962

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 411 546 (YAMANAKA INDUSTRY CO., LTD) 6 February 1991 see page 9, line 21 - line 47; figures 4-6	1,7
Y	DE,C,94 042 (KROTOSCHINER & CO) 16 November 1895 see page 1, right column, line 3 - line 5; figure 1	8,12-15, 17,18,20
A	US,A,1 967 726 (H.W. SHERMAN) 24 July 1934 see page 2, line 4 - line 12	2,11
A	US,A,1 719 947 (G.W. SWIFT, JR.) 9 July 1929 see page 1, line 7 - line 14; figure 2	2
A	WO,A,87 06913 (H.P. CHRISTIE) 19 November 1987 see page 6, line 7 - line 27	6
A	DE,A,30 05 793 (SCHOELLER & HOELSCH KG) 20 August 1981 see claims 1,9,12-14	16
A	DE,C,32 36 459 (WINDMÖLLER & HÖLSCHER) 29 March 1984 see claims 1,2	16
A	GB,A,1 091 073 (JAMES R. CROMPTON AND BROTHERS LIMITED) 15 November 1967 see claims 1,13	7

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. ...l Application No
PCT/GB 93/01962

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0446138	11-09-91	FR-A-	2659364	13-09-91
DE-C-681812		NONE		
DE-A-3700649	21-07-88	NONE		
US-A-3478141	11-11-69	NONE		
EP-A-0411546	06-02-91	AU-B-	632149	17-12-92
		AU-A-	5994690	07-02-91
		CA-A-	2022246	02-02-91
		JP-A-	3229606	11-10-91
DE-C-94042		NONE		
US-A-1967726		NONE		
US-A-1719947		NONE		
WO-A-8706913	19-11-87	AU-B-	587550	17-08-89
		AU-A-	7398487	01-12-87
		EP-A-	0270574	15-06-88
		JP-T-	63503301	02-12-88
		US-A-	4880651	14-11-89
DE-A-3005793	20-08-81	NONE		
DE-C-3236459	29-03-84	EP-A-	0107787	09-05-84
		US-A-	4556527	03-12-85
GB-A-1091073		BE-A-	662582	02-08-65
		DE-A-	1546330	16-07-70
		LU-A-	48409	15-06-65
		NL-A-	6504767	18-10-65